A 2-stage Approach to Craniofacial Reconstruction in an Infected Ovine Mandibular Defect Model

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INTRODUCTION: Reconstruction of infected mandibular defects is challenging due to the size and possible irregular shapes of defects, presence of pathogens, and the availability of suitable donor tissue. We have developed a 2-stage tissue engineering approach in which: (1) an antibiotic-releasing space maintainer is inserted in the mandibular defect to support the formation of a healthy soft tissue envelope and locally eliminate infection and (2) the implantation of a 3-dimensional–printed bioreactor in the ribs to grow a vascularized autologous bony tissue flap of customized geometry. In a second surgery, the space maintainer is removed and replaced with tissue from the bioreactor.

OBJECTIVE: The objective of the current work is to evaluate the effects of treatment of an infected mandibular defect on (1) the presence of pathogens at the mandibular defect and (2) the quality of the bone formed in the bioreactors containing autograft (morselized sheep rib) or a commercially available bone allograft (Bio-Oss; Geistlich). We hypothesized that the presence of an untreated mandibular infection will result in an increased number of clinical complications (ie, mucosal dehiscence) and may negatively affect the quality of the tissues generated in the in vivo bioreactor. Additionally, we hypothesized that both graft materials would be capable of supporting mineralized tissues.

METHODS: In the edentulous region of the mandible of 6 female sheep, a ≈2 cm defect was created superior to the mandibular canal. All animals were inoculated with 10^6 CFU of a bioluminescent strain of *Staphylococcus aureus*. A porous poly(methyl methacrylate)–based space maintainer loaded with vancomycin-containing poly(lactide-co-glycolide) microparticles (n = 3 sheep) or blank microparticles (n = 3 sheep) matching the geometry of the defect was inserted and secured via plate. At the bioreactor site, alternating ribs were exposed, and a ≈4 cm segment of each rib was removed, leaving the underlying periosteum intact. Each animal received two 3-dimensional–printed autograft and 2 allograft bioreactors matching the geometry of the mandibular defect. Blood and oral swabs were taken at 1, 2, 4, and 9 weeks postsurgery. At 9 weeks, animals were euthanized, and the tissues (bioreactors and mandibles) were harvested. Blood was analyzed for complete blood count and systemic vancomycin concentration, swabs for bacteria present, and mandibles and bioreactors for bone quality via microCT. Histologic evaluation and mechanical testing are ongoing.

RESULTS AND CONCLUSIONS: None of the 3 sheep that received vancomycin-loaded space maintainers demonstrated dehiscence, whereas all of the animals in the blank group had dehiscences of varied sizes ($P < 0.05$). The untreated animals had a significant increase in white blood cell count at 1 and 2 weeks postsurgery. Oral swabs yielded bioluminescent bacterial colonies only in the animals with blank space maintainers. MicroCT revealed significantly increased bone volume/tissue volume ratio in the untreated autograft groups relative to treated autograft groups ($P < 0.05$). This study demonstrated that the antibiotic-loaded space maintainer was capable of clearing the localized infection, and that the bioreactor strategy is capable of generating bone using either autograft or a commercially available synthetic allograft.

Intraoperative Frozen Section Analysis for the Excision of Nonmelanoma Skin Cancer: A Single-center Experience

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INTRODUCTION: Recurrence rates for nonmelanoma skin cancers (NMSCs) following Mohs' micrographic surgery (MMS) are consistently lower than standard surgical excision. However, variations in the availability of MMS, waiting times, and costs continue to affect patient preference between treatment modalities. Furthermore, MMS commonly requires delayed reconstruction leading to additional surgeries that increases the risk of adverse outcomes. To achieve curative resection while ensuring optimal cosmetic outcomes, plastic surgeons may utilize intraoperative frozen section-guided excision to forego extensive or delayed reconstruction.

METHODS: Patients presenting with NMSCs undergoing wide local excision using intraoperative frozen section margin analysis (IFSA) at our institution from October

2008 to November 2016 were retrospectively reviewed. Analyzed data included IFSA results, final permanent section histopathology, number of resections required for clear margins, and recurrence rates. Excisions were performed by 1 of 3 plastic surgeons and analyzed by 1 of 8 pathologists.

RESULTS: A total of 171 patients and 204 lesions were included in the study. Mean patient age was 72 years. Operative reports demonstrated that 79.9% of margins were clear after one excision. The remaining 20.1% of cases with residual positive margins after primary excision were identified using IFSA and were re-excised until negative margins were achieved. Of the 20.1%, a total of 11.8% required a second excision and 8.3% required ≥3 excisions. Intraoperative frozen section results revealed 1 false-positive case representing a rate of 0.49% and 5 false-negative results leading to a rate of 2.45%. Fifteen patients had local recurrence; a rate of 7.35%. Frozen section sensitivity was 89.79% and specificity was 99.35%. The positive predictive value was 97.78% with a negative predictive value of 96.85%. Patients had a mean follow-up of 39 months.

CONCLUSION: The resection results and recurrence rate of NMSCs excised at our institution are comparable to national trends using standard surgical excision. The findings suggest that standard surgical excision using intraoperative frozen section analysis is a safe and effective alternative to MMS.

Serial Sterilization of Silicone Breast Implant Sizers Contributes to a Change in Volume as Compared to Permanent Breast Implants

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BACKGROUND: Breast implant sizers are commonly employed as an aid for permanent implant selection during both reconstruction after mastectomy and cosmetic augmentation. Because implant size is one of the most important factors influencing implant selection, the ability of sizer devices to accurately reflect their permanent counterparts is essential. In most facilities, silicone breast implant sizers are reused for multiple surgeries, in accordance with manufacturer recommendations, which allow multiple resterilizations before disposal. However, the sterilization process was observed to introduce air pockets into the silicone sizers which are trapped and retained after repeated sterilization. We hypothesized that introduction of air volume inside sizers contributes to mismatch in permanent implant selection. Therefore, the goal of this study was to determine how serial sterilization changes the volume of breast implant sizers and whether this change results in a clinically significant difference in permanent implant size selection.

MATERIALS AND METHODS: We selected representative devices across a range of volumes (200 to 600 ml moderate profile smooth round silicone breast implant sizers [Mentor Worldwide, LLC., Irvine, Calif.]) and measured their volumes after 10 serial sterilizations. All devices were processed according to the manufacturer recommendations for sterilization. After each resterilization, the device was inspected for the presence of sequestered air and the sizer volume was measured using a water displacement technique. The volume after each resterilization was recorded and the difference between the new volume and the original volume was calculated to show each interval increase in implant volume over the device's lifetime. *T* test analyses were used to determine if there was a statistically significant change in sizer volume.

RESULTS: After 10 sterilizations, a similar absolute increase in volume was found in each device, ranging from 23.88 to 26.54 ml. Interestingly, as a percent, this increase was much greater for the 200 ml sizer (12.85%) than the 600 ml sizer (3.98%). Although the volume did gradually increase with each subsequent sterilization, the largest single increase in volume across all devices and sterilizations was 12.04 ml which occurred as a result of the third sterilization of the 250 ml device. Overall, the change in sizer volume became statistically significant after the fifth sterilization ($P = 0.04$).

CONCLUSION: The manufacturer standard for serial sterilization of breast implant sizers results in an approximately 25 ml increase in volume over the lifetime of the device, regardless of the initial volume of the sizer. As such, sterilization has a much greater impact on smaller volume sizers than on larger volume sizers. Furthermore, a statistically significant change in volume is seen after only 5 rounds of sterilization. This increase in volume may result in the selection of a permanent implant that is actually a size smaller than what was trialed intraoperatively. Therefore, accurate documentation protocols should be introduced to keep precise record of the number of sterilizations that each device has undergone from the time of manufacturing. Additionally, surgeons should adjust their permanent implant selection to account for a possible increase in sizer volume and exercise caution when resterilizing smaller volume silicone sizers.